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An American National Standard

Standard Specification for ~~Skier Goggles and Faceshields~~Ski and Snowboard Goggles[1]

This standard is issued under the fixed designation F659; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

~~1.1This specification covers the minimal requirements for alpine skier goggles and faceshields, to provide a reasonable degree of protection against foreign objects striking or lodging in the eye or surrounding soft tissue causing eye irritation or damage; and to minimize fogging and vision restrictions that distract or handicap the skier and thereby may cause accidents.~~

~~1.2The scope of this specification shall include requirements for materials, lens size, optical properties, lens strength, field of vision, labeling, identification, and testing procedures for goggles and faceshields for alpine skiers.~~

~~1.2.1Contact lenses, sunglasses, and corrective dress eye wear are not included within the scope of this specification.~~

~~1.3The following safety hazards caveat pertains only to the test method portions, Sections 7 and 8 and Annex A1 of this specification:~~

1.1 This specification covers the minimal requirements of ski and snowboard goggles (intended for nonmotorized use) to provide a reasonable degree of protection against snow and moisture striking or lodging in the eye or surrounding soft tissue.

1.2 The scope of this specification shall include requirements for materials, optical properties, lens strength and retention, labeling, identification, and testing procedures.

1.2.1 Contact lenses, sunglasses, and corrective dress eye wear are not included within the scope of this specification. (**Warning—**Impact resistant prescription spectacles that conform to the standard specifications of ANSI Z87.1 should be used if spectacles are to be worn under goggle-type eyewear as covered by this specification.)

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only. Metric units of measurement in this specification are in accordance with the International System of Units (SI). If a value for measurement as given in this specification is followed by an equivalent value in other units, the first stated is to be regarded as the requirement. A given equivalent value may be approximate.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ~~*ASTM Standards:*~~

~~E275Practice for Describing and Measuring Performance of Ultraviolet and Visible Spectrophotometers~~ ASTM Standards:[2]

D1003 Test Method for Haze and Luminous Transmittance of Transparent Plastics

2.2 ~~*American National Standards:*~~

~~ANSI Z80.1Requirements for First-Quality Prescription Ophthalmic Lenses~~ ANSI Standards:[3]

ANSI Z80.3~~Requirements for Nonprescription Sunglasses and Fashion Eyewear~~ Opthalmics—Nonprescription Sunglasses and Fashion Eyewear

ANSI Z87.1 Occupational and Educational Eye and Face Protection Devices

2.3 ~~*Federal Standard:*~~

~~National Institute of Standards and Technology Special Technical Publication 374Method for Determining the Resolving Power of Photographic Lenses (1973)~~ CEN Standard:[4]

[1] This specification is under the jurisdiction of ASTM Committee F08 on Sports Equipment and Facilities and is the direct responsibility of Subcommittee F08.57 on Eye Safety for Sports.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

~~[4] Available from National Institute of Standards and Technology (NIST), 100 Bureau Dr., Stop 3460, Gaithersburg, MD 20899-3460.~~

[4] Available from European Committee for Standardization (CEN), 36 rue de Stassart, B-1050, Brussels, Belgium, http://www.cenorm.be.

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3. Terminology

~~3.1*Definitions:*~~

~~3.1.1*central viewing zone*—that part of a lens which has its center in line with the wearer's line of sight when looking straight ahead. The zone is circular in shape. For the purpose of this specification, it shall be considered to be 38 mm in diameter. The center of the central viewing zone shall be the point of intersection of the line of sight with the lens as mounted on the Alderson headform.~~

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *astigmatism*, *n*—condition in a lens that creates two axially separated line foci of each object point, the lines being mutually perpendicular; in other words, the lens has two different refractive powers in meridians that are 90° apart.

3.1.2 ~~*diopter*—a unit of measure of the refractive power of a lens with a focal distance of 1 m.~~ base-down, *adj*—refers to the type of prism that causes a horizontal beam of light to bend down causing objects to appear higher than their true position.

3.1.3 ~~*eye glasses*—spectacles, sunglasses, or goggles having two separately mounted lenses, but excluding contact lenses.~~ base-in, *adj*—refers to the type of prism imbalance that tends to cause parallel rays of light passing through a protector, spaced apart by the interpupillary distance, to converge.

3.1.4 ~~*face shield*—an eye protective device attached to a helmet or headband(s) and which covers the wearer's eyes and face at least to a point located approximately at the tip of the nose and whose predominant function is protection of the eye.~~ base-out, *adj*—refers to the type of prism imbalance that tends to cause parallel rays of light passing through a protector, spaced apart by the interpupillary distance, to diverge.

3.1.5 ~~*frame*—those parts of eye glasses or goggles containing the lens housings. The frame may be associated with padding.~~ base-up, *adj*—refers to the type of prism that causes a horizontal beam of light to bend upward causing objects to appear lower than their true position.

3.1.6 ~~*goggles*—an optical device worn before the eyes, the predominant function of which is to protect the eyes from the elements without obstructing peripheral vision. They provide protection from the front and sides, and may or may not form a complete seal with the face.~~ binocular, *adj*—relating to the field of view that is shared by both eyes simultaneously; also, any simultaneous activity of the two eyes.

3.1.7 ~~*headband*—that part of the device consisting of a supporting band or other structure that either encircles the head or protective helmet, or can be attached thereto.~~ central viewing zone, *n*—that part of the eye of a protector that has its center in line with the wearer's normal line of sight.

3.1.7.1 *Discussion*—The zone is circular and 40 mm in diameter. The center of the central viewing zone shall be the point of intersection of the line of sight with the lens as mounted on the head form.

3.1.8 ~~*headform optical parameters*—key dimensions for the headforms as provided in Fig. 1.~~ coverage, *n*—characteristic of a protective device that obstructs straight line paths that are coincident with the wearer's eyes.

3.1.9 ~~*mid-saggital plane*—the anteroposterior plane through the longitudinal axis of the body.~~

~~3.1.10*spherical power*—the average of the maximum meridional astigmatic power and the minimum meridional astigmatic power of a lens.~~ cleanable, *adj*—ability of a protective device to be made readily free of dirt or grime without being damaged with a cleaning process, such as the use of soap and water.

3.1.10 *eye*, *n*—relating to the eye of a test head form or the eye of a person wearing a protector.

3.1.11 *eye of the head form*, *n*—all structures contained within the orbital rim of the head form.

3.1.12 *fracture*, *n*—separation, as a result of impact, of a lens or frame into two or more separate pieces.

3.1.13 *haze*, *n*—fraction of the total transmitted light from a normally incident beam that is not transmitted in a focused condition but scattered by inclusions or surface defects.

3.1.13.1 *Discussion*—Excessive haze will reduce contrast and visibility.

3.1.14 *horizontal imbalance*, *n*—difference in prismatic deviation of incident parallel light beams on the two eyes of a protective device in the horizontal meridian (see base-in and base-out).

3.1.15 *impact resistance*, *n*—ability of a device to afford protection from impact as required by this specification.

3.1.16 *lens*, *n*—transparent part or parts of a protective device through which the wearer normally sees.

3.1.17 *normal lines of sight*, *n*—straight ahead horizontal lines that intersect the center of the eyes of the appropriate head-form.

3.1.18 *power imbalance*, *n*—relates to the condition in which the refractive power of the lens or lenses of a protector is different as presented to the two eyes.

3.1.19 *prism, prismatic effect*, *n*—prism bends a beam of light as a result of the lack of parallelism of the two surfaces of a lens through which the beam of light traverses and the amount of bending is a function of the curvatures, thickness, and index of refraction of the material and the angle of approach of the line of sight to the optical surface.

3.1.19.1 *Discussion*—In this specification, the word prism refers to the amount of bending that is imposed upon the line of sight of a wearer of an eye protector for the standard viewing position. Prism is expressed in diopters. The deviation of the line of sight by 1 cm/m is 1 prism diopter.

3.1.20 *protective device (or protector)*, *n*—device that provides protection to the wearer's eye against snow and moisture encountered in non-motorized snow sports.

3.1.21 *refractive power*, *n*—focusing effect of a lens expressed in diopters.

3.1.22 *spherical power*, *n*—average of the maximum meridian astigmatic power and the minimum meridional astigmatic power of a lens.

3.1.23 *test head form*, *n*—for the purpose of this specification, the reference head forms shall conform to EN 168 (current revision).

3.1.23.1 *Discussion*—The two sizes of head forms are medium, which approximates a 50th percentile adult male, and small, which approximates a 60th percentile twelve-year-old child, and both should be of the polyurethane-covered version.

3.1.24 *vertical imbalance*, *n*—difference in prismatic deviation between parallel light beams incident on the two eyes of a protective device in the vertical meridian.

4. ~~Materials and Design~~

~~4.1All parts of a goggle or faceshield shall be free of sharp edges or projections that could cause harm or discomfort to the wearer.~~

~~4.1.1Exposed lens edges shall have a minimum radius in the cross-sectional plane at the entire circumference to limit skin-penetrating ability.~~

~~4.1.2Lens retention shall be sufficient to adequately retain the lens in position, and the frame shall be composed of material that in itself is not hazardous with regard to skin penetration.~~

~~4.1.3Facial contact surfaces shall be of sufficient softness (suggested width 10 mm) and flexibility to minimize body surface injury in case of hard impacts.~~

~~4.2A headband shall be capable of holding the goggle or faceshield securely under normal operating conditions. It shall be capable of easy adjustment and replacement. The "goggle-to-head" holding device shall not contain sharp edges.~~

~~4.3Material(s) utilized in any portion of a goggle or faceshield shall be of durable quality, that is, material characteristics shall not undergo appreciable alterations under the influence of aging or of the circumstances of use to which the device is normally subjected (exposure to sun, rain, cold, dust, vibrations, contact of the skin, effects of sweat, or of products applied to the skin or hair).~~

~~4.4Material(s) commonly known to cause skin irritation or disease shall not be used for those parts of the device which come into contact with the skin.~~

~~4.5Because of environmental climatic changes and personal changes it is considered impossible to control "lens fogging," but any effort to minimize this condition is urged.~~ General Requirements

4.1 *Materials and Design*:

4.1.1 Materials coming into contact with the wearer's face shall not be of a type known to cause skin irritation.

4.1.2 Materials coming into contact with the wearer's face shall not undergo significant change of hardness, loss of strength or flexibility, or other physical change as a result of perspiration, oil from the wearer's skin and hair, or sunscreen lotion.

4.1.3 Goggles shall be free of sharp edges or projections that could cause harm or discomfort to the wearer.

4.1.4 Facial contact surfaces shall be of sufficient softness and flexibility to minimize body surface injury in case of hard impacts.

4.1.5 Headbands shall be capable of holding the goggle securely under normal operating conditions and be capable of ease adjustment.

4.1.6 Materials shall be of durable quality and shall not undergo appreciable alterations under the influence of aging and environmental conditions as occur in the intended field of use (sun, moisture, or cold).

4.1.7 Goggles shall be capable of being cleaned to the degree that, when cleaned in accordance with the method described in 9.1, they shall remain compliant with the requirements of this specification.

4.1.8 The goggle shall be constructed in such a manner as to prevent components of the protector from contact with the eye of the head form, detachment, or dislodgment when tested in accordance with Section 8 of this specification.

4.1.9 Finishes and coatings as used on the protector shall not delaminate from the base surface of the protector such that they dislodge, detach, or delaminate when tested in accordance with Section 8 of this specification.

5. ~~Optical Properties of Skier Goggles and Faceshields~~ Performance Requirements

5.1 *Optical Requirements*:

~~Note1—5.1.2-5.1.6 apply to plano lensed goggles. Prescription lenses must comply with requirements of ANSI Z80.1. Goggles for prescription lenses are to be supplied to the test laboratory with nominal 3-mm thick plano lenses.~~

~~5.1.1 *Field of View*—When tested in accordance with 8.1, goggles or faceshields shall have fields of view equal to or exceeding the following:~~

~~5.1.1.1*Temporal Field*—50°,~~

~~5.1.1.2*Nasal Field*—30°,~~

~~5.1.1.3*Superior Field*—30°, and~~

~~5.1.1.4*Inferior Field*—30°.~~

~~5.1.2*Refractive Tolerances*—When tested in accordance with 8.7, the spherical power (as defined in 3.1.10) shall not be less than −0.37 diopters and shall not exceed+0.06 diopters.~~ —When tested in accordance with 7.7, the refractive power in any meridian shall not exceed 0.12 diopters.

5.1.2 *Astigmatic Power*—When tested in accordance with 7.7, the astigmatic power (absolute power difference in extreme meridians) shall not exceed 0.12 diopters.

5.1.3 ~~*Astigmatism*—When tested in accordance with 8.7, the astigmatism shall not exceed 0.18 diopters.~~ Prismatic Power—When tested in accordance with 7.6, prismatic power shall not exceed 0.50 prism diopters.

5.1.4 ~~*Power Imbalance*—When tested in accordance with 8.7, the maximum meridional power imbalance between the two eyes for straight ahead seeing shall not exceed 0.18 diopters.~~

~~5.1.5*Prism*—For the primary viewing position of either eye of a shield or pair of lenses shall not exceed 0.65 prism diopters when tested in accordance with 8.6.~~ Prismatic Imbalance—When tested in accord with 7.6, prismatic imbalance shall not exceed 0.25 Δ base-in or vertical and 0.75 Δ base-out.

5.1.5 *Ultraviolet Transmittance*—Ultraviolet A (UVA) and ultraviolet B (UVB) transmittance of lenses shall comply with ANSI Z80.3 for both clear and tinted protectors when measured at any point within the central viewing zone.

5.1.6 ~~*Prism Imbalance*—When tested in accordance with 8.6, the prism imbalance shall meet the following criteria:~~

~~5.1.6.1*Vertical Imbalance*—Shall not exceed+0.25 prism diopters.~~

~~5.1.6.2*Horizontal Imbalances*—Negative values (base in) shall not be less than−0.25 prism diopters, and positive values (base out) shall not be more than+1.00 prism diopters.~~

~~5.1.7*Optical Defects*—Within the central viewing zone, striae, warpage, surface ripples, or other defects that are apparent under the optical inspection test conditions of 8.3 shall be considered a failure; except that small specks or inclusions that are not seen when the lens is held close to the eye in the as worn position shall not be a cause of rejection.~~ Haze—When tested in accordance with 7.5, total angle forward scattered light (haze) shall not exceed 3 %.

5.1.7 *Optical Quality*—When tested in accordance with 7.2.2, striae warpage, surface ripples, lenticulations, or abrupt optical changes that are discernible under the test conditions of 7.2 shall constitute a failure.

5.1.8 ~~*Physical Lens Defects*—Within the central viewing zone, pits, scratches, grayness, bubbles, cracks, water marks, or other defects that are apparent under the visible inspection test conditions of 8.5 shall be considered a failure; except that small specks or inclusions that are not seen when the lens is held close to the eye in the as worn position shall not be a cause of rejection.~~

~~5.1.9When tested in accordance with any applicable optical test in 8.6 and 8.7, any goggle or faceshield that does not permit the test target to be brought into focus well enough to make the required measurement will be deemed to have failed that test.~~

~~**6.Light-Transmitting Ability of Eye Protective Devices**~~

~~6.1*Clear Goggle or Faceshield*—A "clear" goggle or faceshield shall transmit not less than 80% of the incident visible radiation. A goggle or faceshield that transmits less than 80% of incident visible radiation shall be considered "tinted."~~

~~6.2*Ultraviolet and Infrared Filtration*—Ultraviolet and infrared filtration shall meet the requirements of ANSI Z80.3 for Special Purpose Lenses.~~

~~6.3~~*Surface and Internal Defects*—Pits, scratches, bubbles, grayness, specks, cracks, and watermarks that are discernible under the test conditions of 7.2 shall constitute a failure.

5.1.9 *Resistance to Fogging*—A goggle ~~or faceshield~~ that is described as being resistant to fogging shall pass the test specified in Annex A1.

~~NOTE2—To claim or describe a goggle or faceshield as being resistant to fogging is optional.~~

~~**7.Lens Strength—Test Methods**~~

~~7.1*Basic Impact Resistance Test*~~ 1—To claim or describe a goggle as being resistant to fogging is optional.

5.1.10 *Field of View*—As tested in accordance with 8.4.

5.1.10.1 *Temporal Field*—50°.

5.1.10.2 *Nasal Field*—30°.

5.1.10.3 *Superior*—30°.

5.1.10.4 *Inferior*—30°.

5.2 *Mechanical Requirements*:

~~7.1.1*Significance and Use*—This test method is intended to ensure a basic level of protection from impact on the surface of a lens of a goggle or on the viewing portion of a faceshield. It may not be representative of all of the conditions of impact experienced in snow skiing.~~

~~7.1.2*Apparatus*—An Alderson 50th percentile male headform (see Fig. 1) shall be used to hold the goggle or faceshield. It shall be rigidly mounted in the horizontal position, face up, on a base that has a mass of 30 kg (66 lb) or greater. The static stiffness of the headform shall be such that, when a vertically downward force of 20 kg (44 lb) is applied to the forehead of the headform, the back of the headform shall not deflect more than 2 mm (0.08 in.). The missile for impacting the goggle or faceshield shall be a polished steel ball, 22 mm (⅞ in.) nominal diameter, and shall have a mass not less than 43 g (1.52 oz). A loose-fitting guide tube shall be provided for the missile.~~

~~7.1.3*Procedure*—Place the goggle or faceshield on the headform as it would be worn by the user. Drop the ball in free fall from a height (measured from the bottom of the ball) of 1.30 m (51 in.) above the exterior surface of the goggle or faceshield. Impact the goggle or faceshield three times: once above the center of each eye of the headform and once above the bridge of the nose of the headform. Test four representative samples of the type of goggle or faceshield.~~

~~7.1.4*Analysis of Results*—The lens shall be retained in its frame, and it shall not fracture into two or more pieces. If all four samples pass the test, then the goggle or faceshield passes, but if any fail, then the goggle or faceshield fails.~~

~~7.1.5*Report*—Fully identify the goggle or faceshield and record whether it passed or failed the basic impact test with spherical projectile. This report is for internal use by the manufacturer and is not included in statements for labeling.~~

~~7.1.6*Precision and Bias*—Precision and bias information is not applicable, because the results of the test are stated qualitatively and not as numerical values of physical quantities.~~

~~7.2*Higher Impact Resistance Test*~~

5.2.1 All interchangeable lenses recommended by the manufacturer shall pass the mechanical strength requirements as specified in this specification when tested in the specified protector.

5.2.2 All goggles that permit interchangeable lenses shall be tested with plano interchangeable lenses, made of the same material, with the same coatings, of the specified minimum thickness, and with the same edge configuration as the interchangeable lenses recommended by the manufacturer.

5.2.3 *Mechanical Strength*:

~~7.2.1*Significance and Use*—This test method is intended to ensure a level of protection from relatively heavy, pointed objects traveling at low speed. It may not be representative of all of the conditions of impact experienced in snow skiing.~~

~~7.2.2*Apparatus*—An Alderson 50th percentile male headform (see Fig. 1) shall be used to hold the goggle or faceshield. It shall be rigidly mounted in the horizontal position, face up, on a base that has a mass of 30 kg (66 lb) or greater. The static stiffness of the headform shall be such that, when a vertically downward force of 20 kg (44 lb) is applied to the forehead of the headform, the back of the headform shall not deflect more than 2 mm (0.08 in.). The missile shall have a 30° conical tip with a 1 mm (0.04 in.) radius, shall have a mass of 500 g (17.6 oz), and shall have a diameter of 25.4 mm (1 in.). The missile shall have a heat treated steel tip. A loose-fitting guide tube with a smooth internal surface shall be provided for the missile. This guide tube is to prevent the missile from tumbling and also to protect the operator. Partial shielding of the headform may be desirable to protect the feet of the operator.~~

~~7.2.3*Procedure*—Place the goggle or faceshield on the headform as it would be worn by the user. Hold the missile above the headform with its tip 130 cm (51 in.) above the exterior surface of the transparent portion of the goggle or faceshield and aligned vertically above one eye of the headform. Allow the missile to fall freely through 130 cm. Test four representative samples of the type of goggle or faceshield.~~

~~7.2.4*Analysis of Results*—The lens shall be retained in its frame, and it shall not crack, fracture, nor be penetrated by the tip of the missile. If all four samples pass the test, then the goggle or faceshield passes, but if any fail, then the goggle or faceshield fails.~~

~~7.2.5*Report*—Fully identify the goggle or faceshield and record whether it passed or failed the higher impact test with high mass, low velocity, pointed projectile. This report is for internal use by the manufacturer and is not included in statements for labeling.~~

~~7.2.6*Precision and Bias*—Precision and bias information is not applicable, because the results of the test are stated qualitatively and not as numerical values of physical quantities.~~

~~8.Optical Test Methods~~

~~8.1*Field of View (Angle of Vision)*~~

5.2.3.1 When tested in accordance with 8.1, any displaced fragments, separated delaminations, or complete fracture of the frame or lenses constitute a failure.

5.2.3.2 When tested in accordance with 8.1, any displacement or dislodgment of the lens from its original position within the frame constitutes failure.

5.2.3.3 When tested in accordance with 8.1, no contact with the eye of the head form shall be permitted either by the lens of the protector or the projectile itself.[5]

5.2.3.4 A protector that is dislodged from the test headform when tested in accordance with 8.1 shall not constitute a failure provided all of the above mechanical requirements are met.

5.2.4 *Lens Strength and Retention* :

~~8.1.1*Significance and Use*—This test method is intended to determine the relative unobstructed angle visually available to the user.~~

~~8.1.2*Apparatus*—Any sighting method may be used, provided that results equivalent to those obtainable with the apparatus described here can be obtained. The test device consists of one or more support plates mounted in vertical and horizontal planes about the Alderson headform as mounted per 7.1.2. Angular gradations may be marked on the support plates to aid in making the angle adjustments. Interpupillary distance shall conform to Fig. 1 for the specified headform.~~

~~8.1.3*Procedure*—Place the goggle or faceshield on the headform as it would be worn by the user. Using a small diameter rod guided by the support plates, move the rod while sighting along its length so that it is concurrently aligned with one of the eye-pupils of the headform and an extremity of the field of unobstructed view provided by the goggle or faceshield. Measure and record the angle the rod forms with a line passing through the eye-pupil, parallel with the sagittal plane and normal to the vertical axis of the headform. Use this procedure for determining the limiting angle of vision in the superior, inferior, temporal, and nasal directions.~~

[5] Zinc oxide ointment has been shown to facilitate this purpose well.

~~NOTE3—A laser pointer may be used in lieu of the rod.~~

~~8.1.4*Analysis of Results*—Compare measured results with the requirements specified in 5.1.5. If all equal or exceed the requirements, the goggle or faceshield passes, but if any is smaller, the goggle or faceshield fails.~~

~~8.2~~

5.2.4.1 When tested in accordance with 8.1, a single lens goggle that allows the missile to rupture the lens shall constitute a failure.[5]

5.2.4.2 When tested in accordance with 8.1, a single lens goggle that allows the frame or lens to fracture shall constitute a failure.

5.2.4.3 When tested in accordance with 8.1, a thermal (dual) lens goggle that allows the missile to penetrate or fracture the inner lens shall constitute a failure.

5.2.4.4 When tested in accordance with 8.1, any displacement or dislodgment of any lens by more than 25 % in single or thermal (dual) lens goggles from its original position within the frame constitutes a failure.

5.3 *UV Stability*—Goggle lenses shall be conditioned in accordance with 8.3. Luminous transmittance of conditioned lenses shall not vary by more than 20 % of their original value. In addition, the product shall meet the requirements of 5.1.7 after conditioning.

5.4 *Water and Snow Protection*—The goggle shall be designed to limit snow or water from entering the goggle and contacting the eyes. When tested in accordance with 8.2 the goggle shall not allow liquid to enter and contact the eye of the head form.

6. Specimen Preparation

6.1 Only new and complete eye protectors as offered for sale shall be tested.

6.2 Protectors shall be preconditioned at 23 ± 2°C (73 ± 3.5ºF) and 50 ± 5 % relative humidity for a minimum period of 24 h before the commencement of any test or further temperature preconditioning.

7. Test Methods

7.1 *Samples Quantity*—Unless otherwise stated, a sample quantity of three devices shall be tested for each requirement and corresponding test method as defined in this section.

7.2 *Optical Quality, Surface, and Internal Defects*—A high-contrast illuminated grid pattern of dark and white lines shall be viewed through the lens, scanning it area by area and moving it about. The grid pattern should be at least 46 by 46 cm (18 by 18 in.) and constructed of high-contrast black lines on a white background (the white separations being equal to the black lines, both being approximately 0.6 cm (¼ in.) wide). The target should be at least 1.8 to 2.4 m (6 to 8 ft) from the observer, and the lens should be held at least 46 to 61 cm (18 to 24 in.) from the eye. Dual lens goggles shall be measured as complete devices assessing the combined effect of both lenses.

7.2.1 Any pits, scratches, bubbles, grayness, specks, cracks, and watermarks that are discernable that would impair the function of the lens shall be cause for failure.

7.2.2 Ripples in the lens detected by this test method should be further examined. Localized power errors or aberrations that are detected are permissible if no measurable or gross focimeter or telescope target distortion or blur is found when the localized area is examined in accord with 7.2.2.1.

7.2.2.1 The referee method of detecting optical defects and local aberrations or to evaluate further aberrations or both detected in 7.2 is to scan the central viewing zone, especially any areas of suspicion arising from the visual test of 7.2. The lens or shield should be scanned with a precision focimeter or an 8 to 10× telescope using the targets and arrangements described in 7.7. The aperture should be 5 to 7 mm for this examination. Areas outside the central viewing zone or within 6 mm of the edge need not be tested. When the central viewing area is scanned, there shall be no sudden jump, doubling, or blurring of the image greater than 0.08 diopter change in power. Gradual variations in the central viewing zone shall be within the power imbalance tolerances. An optical focimeter with electronic readout repeatable to 0.02 diopters is a satisfactory alternate method. These scanning procedures may be made by scanning across the lens surface not necessarily in the "as-worn" mode. Dual lens goggles requiring such assessment shall, if possible, be disassembled such that each lens can be assessed individually.

7.3 *Luminous Transmittance*—Luminous transmittance is a function of the spectral transmittance of the lens weighted by the corresponding ordinates of the photopic luminous efficiency distribution of the International commission on Illumination (CIE) (1931) standard colorimetric observer and the spectral intensity of standard Illumination C (see ANSI Z80.3, Paragraph 3.9.1).

7.4 *Ultraviolet Transmittance*—UVA and UAB transmittance as corresponding to their measured luminous category (see Table 4 of ANSI Z80.3). Dual lens goggles shall be measured as complete devices measuring the combined transmittance of both lenses.

7.5 *Haze*—Measure the protector for percent haze within the central viewing zones in accordance with Test Method D1003 with the protector positioned so that the passing beam of light is as perpendicular to the testing surface as is practicable. Dual lens goggles shall be measured as complete devices measuring the combined haze of both lenses.

7.5.1 The referee method of measuring haze shall be a spectrophotometer with the geometry conforming to Test Method D1003. Commercial "hazemeters" may be used as an alternate method for clear lens samples only.

7.6 *Prismatic Imbalance*:

~~8.2.1*Significance and Use*—Although individual preferences govern the choice of color and darkness of the lens of a goggle or~~